CRYSTAL INSTRUMENTS

Acoustic Control

Application Note 079

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Acoustic Control

Aerospace hardware (i.e., space crafts) require high intensity acoustic level testing, which is usually accomplished inside a RATF (reverberant acoustic test facility). The acoustic noise level inside the RATF at NASA Plum Brook test station can reach 163 dB, which is the highest level among all RATFs around the world. (Figure 1.1)

Figure 1.1 - *RATF (Reverberant Acoustic Test Facility) at NASA Plum Brook (courtesy of NASA)*

Running a high intensity acoustic test requires an acoustic controller and an RATF. Crystal Instruments current EDM 10.0 software release provides Acoustic Control. (Figure 1.2)

Up to a few dozen microphones can be arranged inside the test facility, depending on the size of the DUT and room. The weighted average control strategy is used, allowing the user to set up the weighting for each microphone. (Figure 1.3)

The above input channel setting illustrates the connection of two microphones to input channel 1 and 2, each with a 50% weighting factor towards the averaged control spectrum.

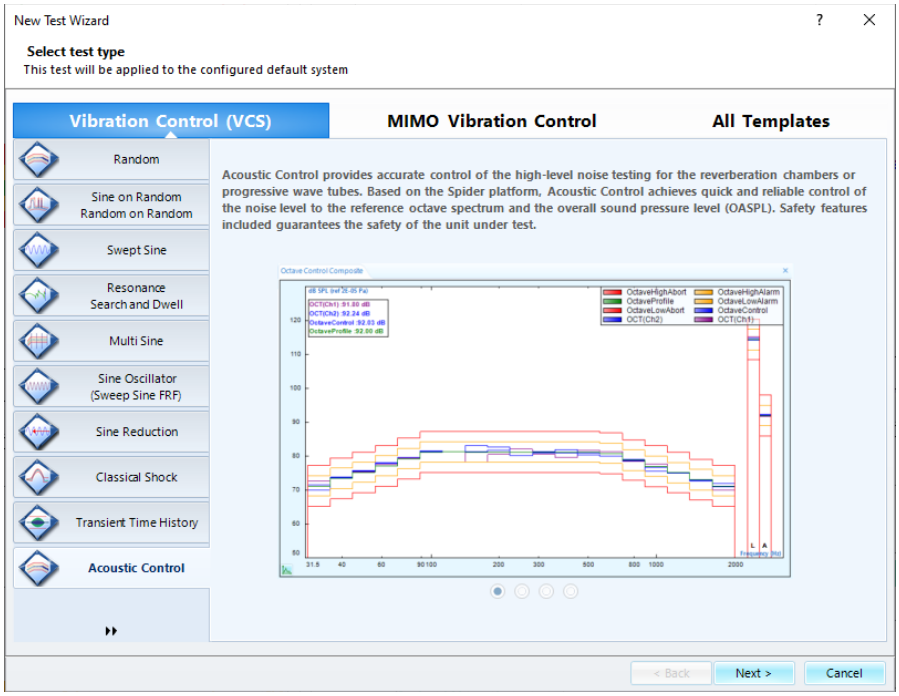

Figure 1.2 - *Acoustic Control of Crystal Instrument's Vibration Control System*

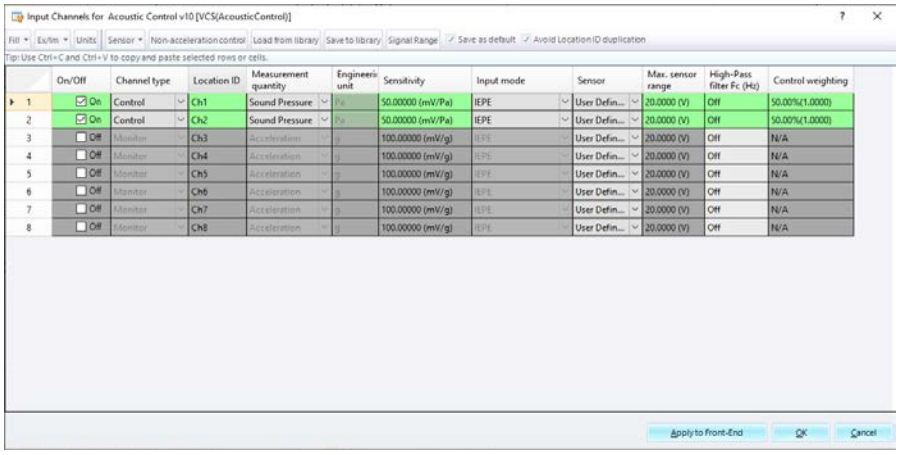

Figure 1.3 - *Weighted average setting with multiple microphones*

Acoustic Control is capable of controlling multiple horns (acoustic power generator). Each horn's working frequency range can be defined based on its specification. (Figure 1.4)

With the above drive setup, four horns are driven to generate the required noise level following the reference octave spectrum. The min and max frequency are set accordingly for each horn. When identical horn types are used, the same drive output can connect these horns together.

Before starting an acoustic test, run pretest to acquire the system frequency response functions based on each horn. Pretest can run automatically or manually. Either method of pretest will measure the system frequency response. (Figure 1.5)

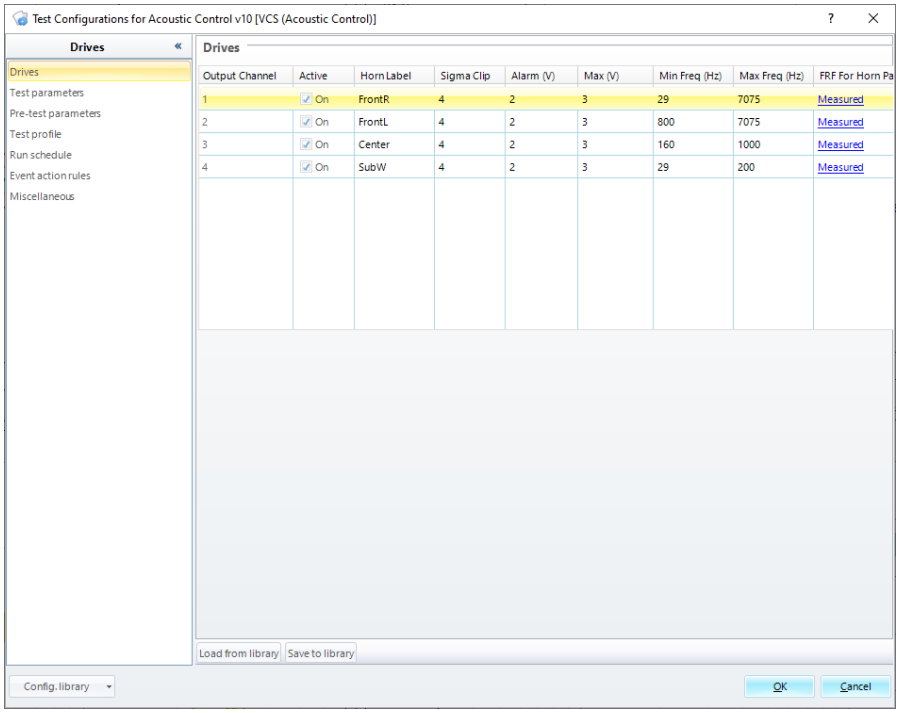

Figure 1.4 - *Drive setup with different horns covering different frequency ranges*

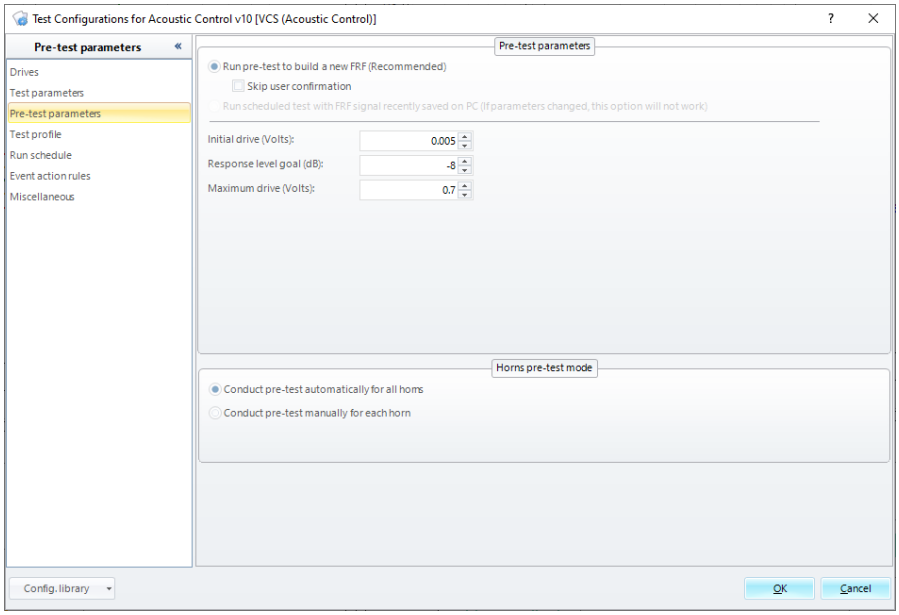

Figure 1.5 - *Pretest setup*

Configure the profile to the target of the required octave spectrum. This is defined through the break point table. (Figure 1.6)

The left side of the spectrum is used to define the overall sound pressure level (OASPL) vs. frequency. The right side is the ultimate octave spectrum used as reference. Available octave band selection are 1/3rd octave, 1/1 octave.

Once the breakpoint table is defined, the related OASPL is determined. In case users want to increase or decrease the PASPL level, “Scale OASPL” can be used to rescale the target level of the profile, as illustrated in the following setup window. (Figure 1.7)

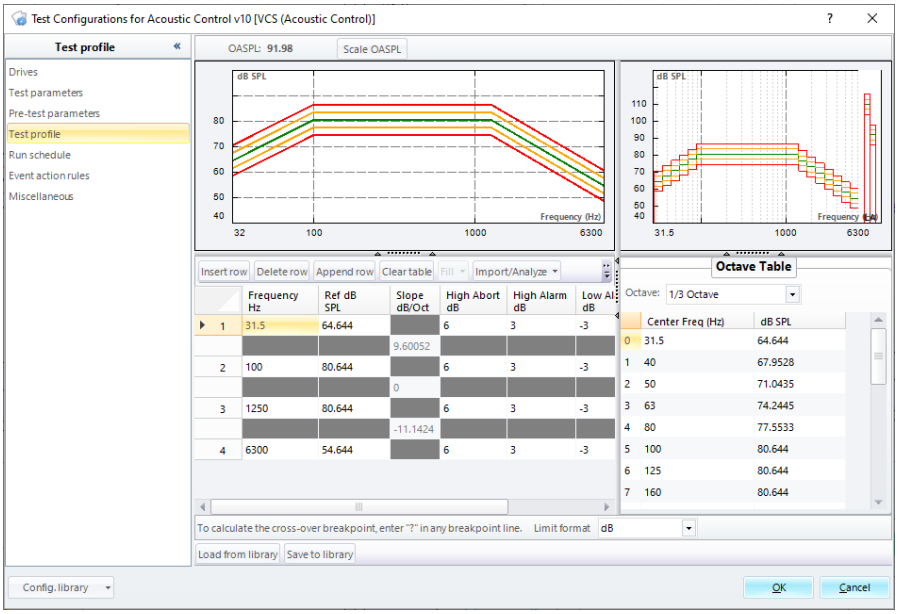

Figure 1.6 - *Reference profile: octave spectrum*

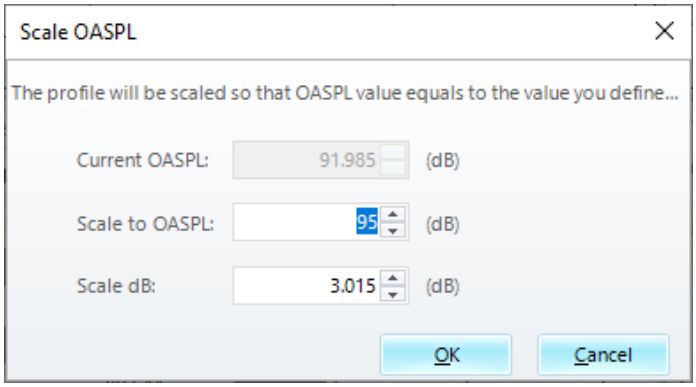

Figure 1.7 - *Rescale the profile*

When all set up is complete, the test can be started. The first stage is pretest if this is the first time running the test. (Figure 1.8)

The pretest status window illustrates the stages of pretest. The horns are turned on sequentially to finish the pretest measurement. After each horn finishes its pretest, the information of the related test to that horn is displayed in the top portion. The preceding screenshot shows all four horns completed the pretest and measured system gains. The system is ready to carry out the acoustic test.

Click the Proceed button shown in the above pretest window to start the test. The test will proceed according to the stage setup in the run schedule. (Figure 1.9)

All associated signals are available for display while the test is running. The control octave spectrum is shown and compared to the profile octave spectrum (top left side graph window), which displays a close visual representation. This confirms the system is under good control.

Contact Crystal Instrumentsat info@go-ci.com for further details regarding Acoustic Control.

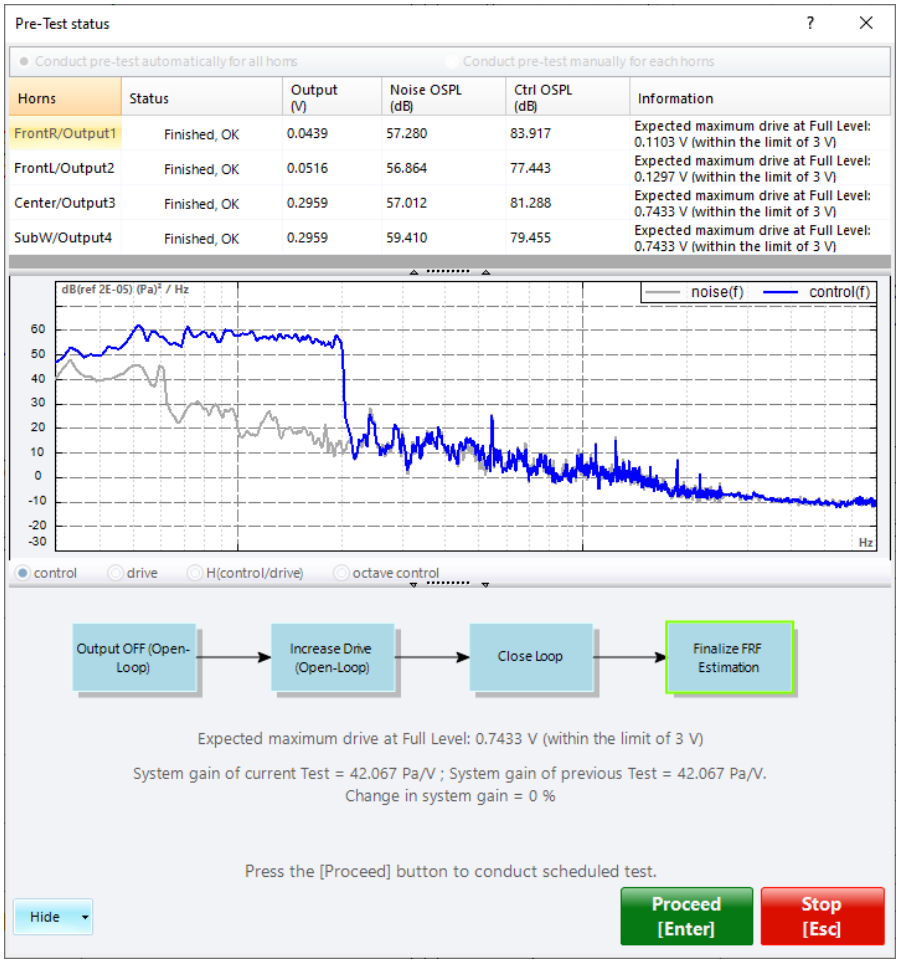

Figure 1.8

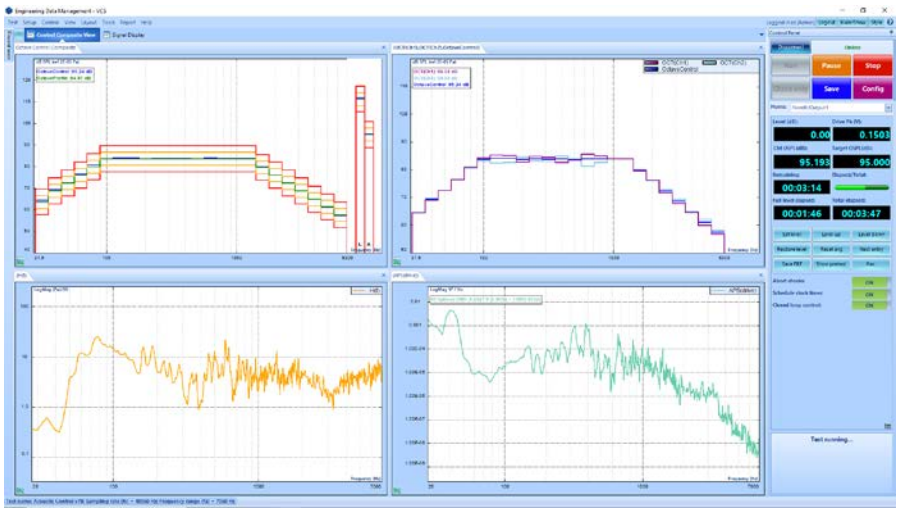

Figure 1.9 - *Acoustic test running at full level*

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